3.2.2 KCRTS/RUNOFF FILES METHOD

The KCRTS/runoff files implementation of HSPF was developed as a tool that has the accuracy and versatility of HSPF but is much simpler to use and provides a framework for efficient design of onsite stormwater detention facilities. This section describes the Runoff Files Method and KCRTS software. The term *runoff files* refers to a database of continuous flows presimulated by HSPF. The KCRTS software package is a tool for using this flow database.

The Runoff Files method was developed as a hydrologic modeling tool for western King County to produce results (design flows, detention pond sizing, etc.) comparable to those obtained with the U.S. Environmental Protection Agency's HSPF model but with significantly less effort. This is achieved by providing the user with a set of 15-minute and hourly time series files of unit area land surface runoff ("runoff files") presimulated with HSPF for a range of land cover conditions and soil types within King County. The design flows are estimated and detention facilities are designed by directly accessing and manipulating the runoff file data by means of the KCRTS software.

At present, the basic capabilities of the KCRTS software include:

- Estimating time series of flows for a specified land use and location within King County
- Analyzing flow frequency and duration
- Analyzing water surface frequency and duration
- Plotting analysis results
- Sizing detention facilities.

❑ DEVELOPMENT OF THE RUNOFF FILES

To compile the runoff files, the land surface hydrologic response (represented by a time series of unit area land surface runoff) was generated by HSPF with regional parameters for a variety of land use classifications and for two long-term (50-year) hourly rainfall stations, one representing the western lowlands of King County (Sea-Tac Airport) and the other representing the eastern foothills (Landsburg). Runoff time series were generated with data from these stations for the following **eight soil/land cover types:**

- Impervious
- Till forest
- Till pasture
- Till grass
- Outwash forest
- Outwash pasture
- Outwash grass
- Wetland.

While HSPF simulates surface runoff, interflow, and groundwater flow**, only the surface and interflow components of runoff are included in the runoff files**. The large majority of developments are relatively small, and it is often not appropriate to include groundwater flows in estimates of the surface or near-surface runoff from a ***site***. For example, in designing detention facilities for a small development on till soils, the total surface or near-surface runoff from the ***site*** would usually consist of surface runoff plus interflow. Groundwater generated on the ***site*** would seep through the underlying till and may reappear (in springs or seeps) some considerable distance from the ***site***. **An interflow component of runoff is not computed for outwash soils** because there is assumed to be no low-permeability subsurface layer. Runoff files for onsite detention facility design were thus generated with the following components:

- Till soils → surface flow + interflow
- Outwash soils → surface flow
- Wetland soils → surface flow + interflow
- Impervious surfaces → surface flow.

The higher elevation eastern portions of King County have a temperature variable hydrologic cycle. **Snowmelt is not accounted for** in either the Sea-Tac or Landsburg runoff files. Additional work may be done to develop snowmelt-based runoff files for use in these areas. In the absence of additional information, analysis will be performed using the Landsburg runoff files scaled by 1.2 for all points east of the 1.2 isoline in Figure 3.2.2.A (p. 3-22).

3.2.2.1 GENERATING TIME SERIES

Most hydrologic analyses will require time series of flows for different land use conditions. For example, to size a Level 1 flow control detention facility, 2- and 10-year peaks from the facility discharge time series must be compared with 2- and 10-year peaks from the predevelopment time series. To generate a flow time series with KCRTS, the KCRTS user needs to specify the following:

1. The **rainfall region** of the county within which the project lies (i.e., determine the rainfall station—Sea-Tac or Landsburg—used in the analysis; see Figure 3.2.2.A, p. 3-22).
2. A multiplier or **regional scale factor** applied to the runoff files to account for variations in rainfall volumes between the ***project site*** and the rainfall station (see Figure 3.2.2.A, p. 3-22).
3. The **time step** to be used in the analysis:
   - Hourly — Used for detention sizing and volume analysis
   - 15 minutes — Used for peak flow analysis of conveyance systems; requires length and slope of the longest unconcentrated surface flowpath for each developed land cover type.
4. The **record type** used in the analysis:
   - Reduced 8-year record, OR
   - Historical — complete historical runoff record may be used.
5. The **amount of land** (acreage) of each soil/cover group for the subbasin under study.
6. The **percentage of impervious area** that is effectively connected to the drainage system.

Generating a new time series is simply a matter of entering the above data into KCRTS under the **"Create New Time Series" routine**. The KCRTS software will then access the appropriate runoff files (representing unit area runoff), scale those files to reflect the location of the ***project site***, scale the files again according to the area of each soil/cover group contained on the ***project site*** or subbasin in question, and then sum the scaled files to produce a time series of simulated flows from the ***site***.

❑ SELECTION OF PRECIPITATION RECORD AND REGIONAL SCALE FACTOR

As noted in the previous section, runoff files for KCRTS were developed using data from two rainfall stations, Sea-Tac Airport and Landsburg. The regions within King County to which data from the two stations apply are shown in Figure 3.2.2.A (p. 3-22). These regions were delineated such that data from Sea-Tac Airport is applied to the drier western part of the county, while data from Landsburg is applied to the wetter eastern part of the county, including developable areas in the Cascade foothills. The line separating the two regions was based on daily rainfall depths.

The *regional scale factor* is a geographically variable multiplier applied to the flow time series to account for the considerable variations in rainfall amounts, and hence runoff, within the two regions, especially in